Development of a Data Acquisition System for 4π Ge-spectrometer

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The aim of our study is the acquisition of neutron cross-section data for the minor actinides (such as ^{237}Np, ^{241}Am and ^{243}Am) that are important for the development of innovative nuclear reactor technology. We develop a new advanced measurement technology for the acquirement of neutron cross-section data of the minor actinides. In this technology, we construct a 4π Ge-spectrometer utilizing a prompt gamma-ray spectroscopic method with multiple gamma-ray detection (gamma-gamma coincidence) method. This spectrometer consists of 30 Ge crystals and BGO anti-Compton shields. Normally, a data acquisition system for such a big Ge spectrometer consists of many NIM modules; it requires large space; in addition, its cost of this system becomes huge (more than 2 million dollars per one Ge detector channel). To overcome these problem, we developed a new data acquisition system for the 4π Ge-spectrometer with digital signal processing (DSP) techniques. This system consists of three Main ADC modules, which measure the energy of gamma rays with DSP technique, five Fast Timing modules and a Coincidence module to detect a coincidence condition and to measure timing data. The preamplifier outputs of the Ge detectors are directly put into the Main ADC modules and the Fast Timing Modules. The outputs of BGO anti-Compton detectors are only put into the Fast Timing Modules. All modules can be mounted a 19 inches VME sub-rack, the cost of this system is less than 2000 dollars per one Ge detector channel.

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